

REMARKS

Reconsideration is respectfully solicited.

Applicants respectfully traverse the rejection of claims under 35 U.S.C. § 103(a) as being obvious over Fan et al. (EP 0446672) in view of Tsukamoto et al. (U.S. Patent 5,902,715), Ueno (JP 09243869), Watanabe et al. (U.S. Patent 6,218,281), and the Elliott excerpt.

The Patent Office agreed with Applicants' arguments that **the combined disclosures of Fan et al., Tsukamoto et al., Watanabe et al., and the Elliott excerpt did not establish a *prima facie* case of obviousness.** Ueno was thus applied in the most recent Office Action, allegedly to make up for the deficiencies of the grounds of rejection based on the four references (Fan et al., Tsukamoto et al., Watanabe et al., and the Elliott excerpt):

"The Examiner agrees that the previous combination of references did not render obvious the currently claimed invention...The previously applied references dry the coating prior to exposure. The addition of Ueno...addresses that." (Final Rejection, page 6, first paragraph.)

Applicants respectfully request reconsideration. Applicants do not believe that combined disclosures of Fan et al., Tsukamoto et al., Watanabe et al., Ueno and the Elliott excerpt establish a *prima facie* case of obviousness. In summary, (a) there is no teaching and the Patent Office has presented no rationale to combine the references, (b) to arrive at the present invention, and (c) there is no teaching in the references that would lead one to expect the superior properties demonstrated by the invention.

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable

expectation of success must both be found in the prior art, not in applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

In Applicants' view, the method claims at issue are not obvious in view of the previously applied four references taken in view of Ueno, as there is no suggestion or motivation in the applied art to make the optical wave guide of the rejected claims by the spin-coating application of a liquid film layer and irradiating the liquid film layer in the liquid state.

In the present invention, the mixture, which is spin-coated onto the under cladding layer, is still in liquid form, *i.e.*, still has a viscosity as prepared, at the start of the irradiating step to form a latent image because no drying or baking step is performed after Applicants' spin-coating step. In other words, the mixture is a liquid having a viscosity ranging from 500 to 10,000 cps at the start of the irradiating step (Please see claim 13).

In Applicants' view Ueno does not make up for the deficiencies of the previously applied four references. JP H09-243869 to Ueno teaches a method for connecting optical parts by dipping in a photosensitive solution and irradiating by laser beam. In Ueno, a liquid layer is formed by dipping a base substrate containing optical parts thereon in the photosensitive solution, followed by irradiating laser beam to form **only a core** of a waveguide. The core so formed is surrounded by liquid material which acts as cladding.

In contrast to Ueno, the liquid photosensitive material of the present invention is spin-coated onto a substrate to form a film in liquid state. The film in liquid state is irradiated by actinic radiation with an appropriate mask to cure necessary portion(s) of the film. A core and both lower and upper cladding(s) can be formed sequentially with the method described above.

The liquid photosensitive material of the present invention has a viscosity of 500 to 10,000 cps. Illustrative liquids having a viscosity of 500 cps include olive oils or castor oils.

Further, an illustrative liquid having a viscosity of 10,000 cps includes honey. Such a high viscous liquid used in the present invention will increase the difficulty to form a thin film with high uniformity in thickness. The dipping method employed by Ueno will not provide a film of highly uniform thickness with such a highly viscous liquid. In the present invention, a film having high uniformity is provided by spin-coating method rather than dipping method; with the film is in the liquid state. Neither feature is described by Ueno. Moreover, Ueno provides no motivation to alter the conditions of the four previously applied references.

In addition, only the core is cured by the method of Ueno, and it would appear impossible to sequentially form the lower cladding, the core, and the upper cladding by the method of Ueno. Further, sequential formation of the lower and upper claddings and the core is impossible, even though the teaching of Ueno is combined with those of the other cited references.

Neither Fan et al., Tsukamoto et al., Watanabe et al., nor the Elliot excerpt suggests modification of Ueno and/or Applicants' claimed viscosity range to arrive at Applicants' claims. Applicants consider that irradiation of the mixture while in the liquid state is advantageous to obtain a more uniformly cured product with superior properties to that obtained from such a mixture irradiated in the solid state. This feature is thus submitted to clearly differentiate the present invention as claimed from the prior art.

The primary reference, Fan et al., teaches baking after applying a photosensitive layer in order to drive off solvents and before lithographic exposure (see page 10, lines 40-53). Thus, in the method of Fan et al., it is submitted to be clear that the coated photosensitive layer is in the solid state during the lithographic exposure step unlike the method of the present invention.

Tsukamoto et al. teaches removing solvents after a coating step and before irradiation to ultraviolet rays (see col. 18, line 3 *et seq.*). Tsukamoto et al. additionally teaches that removal of solvents can be carried out by leaving the coated film as-is by heating or by decompression (see col. 18, lines 14 and 15). By removing solvents from the coated film in the method of Tsukamoto et al., the coated film is thus dried, *i.e.*, changed from the liquid state to the solid state, unlike the method of the present invention.

Moreover, when using the composition of Table 1 (see col. 30) of Tsukamoto et al., the content of EHPE-3150 in the coated film is calculated to be 59% after removing the dichloromethane and tetrahydrofuran. Taking into account Table 1, on page 11 of the present specification, Applicants estimate that the viscosity of Tsukamoto et al.'s coated film would be over 10,000 cps, which falls outside of the scope of Applicants' claims.

Watanabe et al. teaches spin-coating of a photoresist liquid having a viscosity of 3,800 cps (see col. 6, line 50, *et seq.*). The coated photoresist film is then immediately cured at a temperature of 100°C for 6 minutes before exposure to ultraviolet rays (see col. 6, lines 53 and 54). The preferred viscosity range in Watanabe et al. is given as 3,000 to 4,000 cps (see Col. 7, lines 1 and 2). Thus, the photoresist film of Watanabe et al. is in the solid state during the exposure step as a result of the preceding curing step. Thus, clearly the viscosity of the photoresist film in the exposure step is not 3,800 cps.

The Elliott excerpt is relied upon by the Examiner as teaching spin coating techniques. Applicants submit, however, that the Elliott excerpt does not seem to supply the disclosure missing from the other references needed to construct a *prima facie* case of obviousness.

The Examiner's combination of references does not teach or suggest a method in which a spin-coated photosensitive film of materials of specific viscosity parameters, remains in the

liquid state during an irradiation (exposure) step. Moreover, Applicants submit that the Examiner's combination of references may not be fairly said to teach or suggest the advantage achieved by Applicants' method of providing a more uniformly cured product, *i.e.*, the core of the waveguide, so that this ground of rejection should be withdrawn.

Applicants present a DECLARATION to show the advantage(s) of curing in liquid form. In the DECLARATION, the employed substance EHPE-3150 has a softening point of $85\pm 10^{\circ}\text{C}$ and is a solid at room temperature. Therefore, in order to obtain a thin film of EHPE-3150, the Declarant dissolved it in organic solvents, such as THF, with a photo initiator, followed by spin-coating the resultant solution and curing by irradiation of ultraviolet light.

In this situation, it is reported that EHPE-3150 is present as solid in the spin-coated film, regardless of whether it is photo-cured or not. So, there is a disadvantage that scattering loss of the spin-coated film appears to increase to where thickness of the film is several micrometers or more. Further, the photo-cured film of EHPE-3150 has a scattering loss of greater than 1 dB/cm for a $0.85\text{ }\mu\text{m}$ light.

Furthermore, when film thickness is increased to several ten micrometers, the Declarant reports, the film becomes clouded and inappropriate for use as a waveguide film.

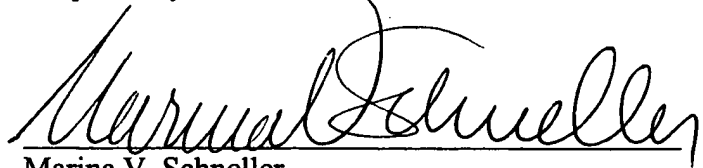
In producing a film by spin-coating and photo-curing EHPE-3150, selection of solvents is important. Alcoholic solvents such as methanol have insufficient solubility, so that a film having a thickness of several micrometers become clouded to give high scattering loss. The high scattering loss makes the film inappropriate to use as a waveguide.

In contrast to the above, when the method of the present invention is used, a highly transparent film having a loss of 0.1 dB/cm or less for a $0.85\text{ }\mu\text{m}$ light can be obtained even in a

large thickness of several ten micrometers. By comparison, the present invention, where a film in liquid state is irradiated by ultraviolet light for curing, has a great advantage over the prior art.

Reconsideration of the outstanding Office Action and an early allowance of the application are respectfully solicited.

Respectfully submitted,



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